of which I give in the following extract from Saunier's "Traité D'Horlogerie Moderne."

"M. Phillips a démontré, dans un Mémoire présenté à l' Académie des sciences, que l' étendue des oscillations du balancier, où le défaut d' équilibre s'apercevra le moins au réglage dans les différentes positions inclinées, est de 439°28′, soit en nombre rond 440°, un peu moins de 1 tour $\frac{1}{4}$."

Whether this demonstration was analytical or experimental I cannot say, not having seen the Memoir referred to. In the course of twenty years experience in rating and adjusting watches and pocket chronometers, many opportunities have occurred to verify Prof. Phillips' conclusion.

The arc mentioned seems to be independent of the amount of error of poise, as experiments with a balance only slightly out of poise, and with the same balance after removing a whole screw from one portion of its rim will show.

In a marine chronometer, the balance vibrates in a horizontal plane, and is not so susceptible to errors of poise, but if the balance is made to vibrate as near to this arc as possible, any induced polarity, caused by the magnetism of iron ships, will not cause so much irregularity in the rate as it would if the balance had either a larger or smaller arc of vibration.

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FURTHER REMARKS ON THE SOLUTION OF PROBLEM 260, BY THE EDITOR.—The solution of problem 260, given at pp. 121–122, as corrected by the Note at p. 151, is, we trust, a sufficient discussion of that question, as announced at p. 95. It will be seen, however, that equations (2) and (3) as written at the top of p. 122 (with a slight alteration of signs), are adapted to the solution of a different question, viz., Prob. 8, ANALYST, Vol. I, page 35.

Writing $R+r$ instead of $R-r$ in (2) and changing all the signs in (3), equation (1) retaining the negative sign, as written at p. 121, we have, for the equivalent of (6) on p. 122,

$$\left(\frac{d\varphi}{dt}\right)^2 = \frac{10}{7}\,\frac{g}{R+r}\left(1-\cos\varphi\right); \tag{6}$$

and writing $R'=0$ in (3) it becomes

$$\left(\frac{d\varphi}{dt}\right)^2 = \frac{g}{R+r}\cos\varphi. \tag{7}$$

Equating the right hand members of (6) and (7) and reducing, we get $\cos\varphi = \frac{10}{17}$. (See foot-note, p. 35, ANAL. Vol. I.)

If, instead of quitting the sphere when $R' = 0$, the rolling sphere is constrained to move on the surface of the fixed sphere until $\cos\varphi = 0$, then will the solution of (6) give the time t, in which the rolling sphere will descend from the summit of the fixed sphere over one fourth of its circumf., viz.;

$$t = \frac{1}{\sqrt{a}}\left[\frac{2}{\sqrt{2}}\log\frac{\sqrt{(1+\cos\varphi)} - \sqrt{2}}{\sqrt{(1-\cos\varphi)}}\right]_0^{\frac{\pi}{2}},$$

where $a = 10g \div 7(R+r)$.

This value of t, is not $[2 \div \sqrt{(2a)}]\log(1-\sqrt{2})$, as indicated at p. 122, $[2 \div \sqrt{(2a)}]\log(1-\sqrt{2})$ being the value of the integral at the superior limit only. At the inferior limit we have

$$\frac{\sqrt{(1+\cos\varphi)}-\sqrt{2}}{\sqrt{(1-\cos\varphi)}} = \frac{0}{0}, \text{ a vanishing fraction, whence}$$

$$\frac{-\sqrt{(1-\cos\varphi)}}{\sqrt{(1+\cos\varphi)}} = \frac{-0}{\sqrt{2}} = -0.$$

$$\therefore\ t = \frac{2}{\sqrt{(2a)}}\log\frac{1-\sqrt{2}}{-0} = \frac{2}{\sqrt{(2a)}}\log\frac{\sqrt{2}-1}{0} = \infty.$$

That is, the time required, to roll from the *summit* of the fixed sphere over one fourth of its circumference, is infinite.

If, instead of starting from the summit of the fixed sphere, the rolling sphere should start from a point, say $1''$ from the summit, the time, obviously, would be finite. In that case the time would be, as calculated by Mr. Kummell, $t = \sqrt{(2 \div a)} \times 12.7418368$.

SOLUTIONS OF PROBLEMS IN NUMBER FIVE.

SOLUTIONS of problems in No. 5 have been received as follows:

From R. J. Adcock, 277; Alex. S. Christie, 276, 278, 279, 280; Prof. W. P. Casey, 278; G. M. Day, 276, 278; Prof. E. J. Edmunds, 276, 277, 278; Henry Gunder, 276, 278, 280; Henry Heaton, 276, 277, 278, 279, 280; Chas. H. Kummell, 276, 277, 278, 279, 280; Prof. D. J. McAdam, 279; O. L. Mathiot, 276; W. L. Marcy, 276, 278, 279; K. S. Putnam, 276; P. Richardson, 276; Prof. E. B. Seitz, 276, 278, 279, 280; Prof. J. Scheffer, 278, 280; Prof. D. Trowbridge, 278, 279, 280.

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276. "Given the chord AC of a circle, the side AB of a right angled triangle constructed on AC as hypothenuse, and the length of a perpendicular from A upon the line joining the right angle at B with the centre of the circle; to find the radius of the circle."